DOCUMENT RESUME

ED 401 424 CE 072 916

TITLE	Specification for Qualification and Certification for Level II - Advanced Welders.
INSTITUTION	American Welding Society, Miami, FL.
SPONS AGENCY	Department of Education, Washington, DC.
REPORT NO	AWS-QC11-96
PUB DATE	96
CONTRACT	V244B30006-95
NOTE	55p.; For the final program report, see CE 072 915. For related specifications and guides, see CE 072 917-919 and ED 398 388-389.
AVAILABLE FROM	American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; phone: 800-334-WELD.
PUB TYPE	Legal/Legislative/Regulatory Materials (090) -- Guides - Non-Classroom Use (055)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	*Certification; *Employment Qualifications; Evaluation Criteria; *Minimum Competency Testing; Performance Tests; Postsecondary Education; Records (Forms); *Specifications; *Trade and Industrial Education; *Welding

ABSTRACT

This document defines the requirements and program for the American Welding Society (AWS) to certify advanced-level welders through an evaluation process entailing performance qualification and practical knowledge tests requiring the use of advanced reading, computational, and manual skills. The following items are included: statement of the standard's scope; definitions of key terms; requirements for participating organizations; purposes/scope of the written examinations and performance tests; inspection, testing, and acceptance criteria; documentation requirement; certification procedure; and information about the National Registry of Level II-Advanced Welders. Appended are the following: workmanship qualification test report; face- and root-bend test report; optional AWS certification tests; and welding procedure specifications. Twelve figures/tables are included. (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 401 424

AWS QC11-96

Specification for Qualification and Certification for Level II - Advanced Welders

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy

CE 072 916

American Welding Society

BEST COPY AVAILABLE

Key words — advanced level welder, participating organization, performance tests, acceptance criteria, National Registry

Specification for Qualification and Certification for Level II - Advanced Welders

Funded by the
U.S. Department of Education
Grant V244B30006-95

Prepared by the
AWS Education and Certification Departments

Under the Direction of the
AWS Education Grant Committee

Approved by the
AWS Board of Directors

Abstract

This standard defines the requirements and program for the American Welding Society to certify advanced level welders. The certification of Level II - Advanced Welders requires performance qualification and practical knowledge tests. These tests require more detailed skills of reading, computational, and manual skills to complete.

American Welding Society
550 N.W. LeJeune Road, Miami, Florida 33126

Statement on Use of AWS Standards

All standards (codes, specifications, recommended practices, methods, classifications, and guides) of the American Welding Society are voluntary consensus standards that have been developed in accordance with the rules of the American National Standards Institute. When AWS standards are either incorporated in, or made part of, documents that are included in federal or state laws and regulations, or the regulations of other governmental bodies, their provisions carry the full legal authority of the statute. In such cases, any changes in those AWS standards must be approved by the governmental body having statutory jurisdiction before they can become a part of those laws and regulations. In all cases, these standards carry the full legal authority of the contract or other document that invokes the AWS standards. Where this contractual relationship exists, changes in or deviations from requirements of an AWS standard must be by agreement between the contracting parties.

International Standard Book Number: 0-87171-473-6

American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126

© 1996 by American Welding Society.
All rights reserved

Printed in the United States of America

Note: The primary purpose of AWS is to serve and benefit its members. To this end, AWS provides a forum for the exchange, consideration, and discussion of ideas and proposals that are relevant to the welding industry and the consensus of which forms the basis for these standards. By providing such a forum, AWS does not assume any duties to which a user of these standards may be required to adhere. By publishing this standard, the American Welding Society does not insure anyone using the information it contains against any liability arising from that use. Publication of a standard by the American Welding Society does not carry with it any right to make, use, or sell any patented items. Users of the information in this standard should make an independent, substantiating investigation of the validity of that information for their particular use and the patent status of any item referred to herein.

With regard to technical inquiries made concerning AWS standards, oral opinions on AWS standards may be rendered. However, such opinions represent only the personal opinions of the particular individuals giving them. These individuals do not speak on behalf of AWS, nor do these oral opinions constitute official or unofficial opinions or interpretations of AWS. In addition, oral opinions are informal and should not be used as a substitute for an official interpretation.

This standard is subject to revision at any time by the AWS Certification Committee. Comments (recommendations, additions, or deletions) and any pertinent data that may be of use in improving this standard are requested and should be addressed to AWS Headquarters. Such comments will receive careful consideration by the AWS Certification Committee and the author of the comments will be informed of the Committee's response to the comments. Guests are invited to attend all meetings of the AWS Certification Committee to express their comments verbally. Procedures for appeal of an adverse decision concerning all such comments are provided in the Rules of Operation of the Technical Activities Committee. A copy of these Rules can be obtained from the American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126.

Personnel

AWS Education Grant Committee

F.G. Delaurier, Chairman	American Welding Society
N.C. Wall, Vice Chairman	American Welding Society
R.V. Reeve, Co-Secretary	American Welding Society
J.R. Hufsey, Co-Secretary	American Welding Society
R.L. O'Brien, Program Manager	American Welding Society
J. Bartley	Consulting Engineer
S.W. Bollinger	The Esab Group, Inc.
F. Cusma	Pacific Northwest Ironworkers
J.E. Greer	Standard Refrigeration/Autorad
S.C. Helzer, Advisor	University of Northern Iowa
J. Hoeft	Miller Electric Mfg. Company
D.G. Howden	The Ohio State University
J.H. Ivy	Ingalls Shipbuilding
L.G. Kvidahl	Ingalls Shipbuilding
R. Murray	H & M Steel, Inc.
L.W. Myers	Dresser-Rand, Inc.
A.L. Petroski	Valmet, Inc. Honeycomb Division
R.C. Pierce	Welding Engineering Supply Co.
S.L. Raymond	National Training Fund
R.J. Teuscher, Ex-Officio	Industrial Gas Products
E.R. Bohnart, Ex-Officio	Miller Electric Mfg. Company
C.E. Pepper, Ex-Officio	Lockwood Greene Engineers

Foreword

(This Foreword is not a part of AWS QC11-96, *Specification for Qualification and Certification of Level II - Advanced Welders*, but is included for information purposes only).

This standard extends the work of the American Welding Society to further define a national skill standard for the Level II - Advanced Welder. The American Welding Society was awarded Grant #V244B30006-95 for $1,059,626 by the U.S. Department of Education to develop standards and a certification program for welders during the period from July 1993 to July 1996. The total program cost is $2,132,094, of which 49.7% ($1,072,468) is an in-kind contribution by AWS.

To accomplish its goals, AWS organized an Education Grant Committee, which has representatives from all segments of the welding industry, including labor organizations and educational institutions. This Committee has overseen the efforts toward a standard for the qualification and certification of the Level II - Advanced Welder.

The development of this National Skill Standard has involved the participation of the welding industry through a survey designed to determine a consensus of welder skills and competencies required for individuals seeking to continue the development of their welding skills.

The results of this industry survey were an occupational task analysis that formed the basis for curriculum guidelines to guide the training of the Level II - Advanced Welder candidate.

This standard defines the requirements for the certification of such individuals and their entry into the National Registry of Level II - Advanced Welders.

Comments and suggestions for improvement of this standard are welcome. They should be sent in writing to the Secretary, AWS Certification Committee, American Welding Society, 550 N.W. LeJeune Road, Miami, Florida 33126.

Table of Contents

Page No.

Personnel iii
Foreword iv
List of Tables vi
List of Figures vi

1. Scope 1

2. Definitions 1

3. Requirements for Participating Organizations 2

4. Written Examinations 3

5. Performance Tests 3

6. Inspection, Testing, and Acceptance Criteria 4

7. Documentation 5

8. Certification 5

9. National Registry of Level II - Advanced Welders 5

Annex A - Workmanship Qualification Test Report 8

Annex B - Face- and Root-Bend Test Report 9

Annex C - Optional AWS QC7 Certification Tests 10

Annex D - Welding Procedure Specifications 20

List of Tables

Table		Page No.
1	Visual Inspection Criteria for Level II - Advanced Welders	6
2	Acceptance Criteria for Face- and Root-Bends	7

List of Figures

Figure		Page No.
1	SMAW Workmanship Qualification Test	22
2	GMAW (Spray Transfer) Workmanship Qualification Test	23
3	GMAW (Spray and Short Circuit Transfer) Workmanship Qualification Test	24
4	FCAW-S and FCAW-G Workmanship Qualification Test	25
5	GTAW Workmanship Qualification Test	26
6	SMAW Performance Qualification Test	27
7	SMAW Test Pipe Specimen Locations	28
8	Face- and Root-Bend Specimens	29
9	Typical Guided-Bend Test Fixture	30
10	Alternative Wrap Around Bend Test Fixture	31

Specification for Qualification and Certification for Level II - Advanced Welders

1. Scope

1.1 This standard establishes the minimum requirements for an organization to participate with the American Welding Society (AWS) in the qualification and certification of advanced welders.

1.2 This standard specifies practical knowledge and performance tests that require a more detailed level of reading, computational, and manual skills to successfully complete.

1.3 All individuals that meet the specified performance at a facility meeting **3. Requirements for Participating Organizations** will be listed in The National Registry of Level II - Advanced Welders at the American Welding Society.

1.4 Organizations not meeting **3. Requirements for Participating Organizations** may use this standard, but individuals they certify will not be listed in the National Registry of Level II - Advanced Welders.

1.5 Although a written test including questions on safety is required by this standard, this standard is not intended to address safety and health. Safety and health requirements are provided in ANSI Z49.1, *Safety in Welding and Cutting*, other safety and health standards, and federal, state, and local government regulations. The responsibility for safety of the Level II - Advanced Welder is primarily with the welder, the Participating Organization during training and testing, and afterwards, with the employer.

1.6 The requirements of this standard shall not supersede the authority of the training facility as established by the local evaluation guidelines.

2. Definitions

The terms used in this standard are defined in ANSI/AWS A3.0, *Standard Welding Terms and Definitions*. Other terms are defined as follows:

1) Participating Organization - Any organization meeting **3. Requirements for Participating Organizations**.

2) Level II - Advanced Welder - An individual employed in this position is considered to possess a prerequisite amount of knowledge, attitude, skills, and habits required to perform proceduralized tasks under general supervision, and complex tasks involving the use of theoretical knowledge and motor skills under close supervision.

3. Requirements for Participating Organizations

3.1 Participating Organizations may be training-and-testing or testing-only facilities.

3.2 Participating Organizations shall maintain and follow a quality manual that assures compliance with this specification.

3.3 An application for registration as a Participating Organization shall be submitted with a cover letter signed by the Senior Official at the Facility. The cover letter shall certify to AWS that the Facility has a Quality Program which will be rigorously followed, and that the requirements of this standard will be met.

3.3.1 If the Participating Organization is a training-and-testing organization, the letter shall also state that their curriculum follows AWS EG3.0, *Guide for Training and Qualification of Welding Personnel - Level II - Advanced Welders*.

3.3.2 Participating Organizations already registered for the Entry Level Welder training program must notify AWS of their intention to administer the Level II - Advanced Welder curriculum.

3.4 Test supervisors for testing-and-training or testing-only Participating Organizations should be AWS Certified Welding Inspectors.

3.5 Instructors for testing-and-training Participating Organizations should be AWS Certified Welding Educators.

3.6 Quality System Audits. Audits may be required if evidence of nonconformance with the Participating Organization's Quality Program or this specification exists.

3.6.1 Allegations of nonconformance supported by documentary evidence will be presented to the AWS Certification Committee. The Committee may require:

1) A written statement by the Senior Official of the Participating Organization with supporting evidence refuting the allegations, and a statement by the Senior Official of the Participating Organization that the requirements of the Participating Organization Quality Program and this Specification have been met in the past, and will be met in the future, or

2) An on-site quality audit by an AWS Approved Assessor to verify that the requirements of the Quality Program and this Specification have been and are being met.

3.6.2 If a quality audit is required by the Committee, then the Participating Organization has two options, as follows:

1) The Participating Organization may decline to be audited and resign from the Program, or

2) The Participating Organization may agree to be audited, in which case the Senior Official of the Participating Organization shall issue a purchase order to AWS for administrative fees and expenses of the assessor.

4. Written Examinations

4.1 The written examinations are designed to show that the Level II - Advanced Welder understands the following subjects:

Mathematics
Employability Skills
Safe Practices
Welding Terms and Definitions
Layout/Fitup Principles and Practices
Codes/Standards
Qualification and Certification
Welding Specifications
Welding Theory
Weldability
Welding Inspection and Testing
Cutting Theory
Cutting Terms and Definitions

4.2 A minimum passing grade of 75% is required with at least 90% of the safety questions answered correctly, with no limits on retests. Individuals failing one part of the written examination must retest on all parts of the examination.

5. Performance Tests

Performance tests are designed to show that the Level II - Advanced Welder can:

1) Pass workmanship qualification tests using SMAW, using stainless steel filler metal on carbon or stainless steel.
2) Pass a performance qualification test using SMAW on carbon steel pipe in the 6G position.
3) Pass workmanship qualification tests using GMAW in spray transfer mode on aluminum, all positions.
4) Pass a combination pipe and plate workmanship qualification test using GMAW on carbon steel, in short circuit and spray transfer modes, in positions 2F, 5G, and 5F.
5) Pass a combination pipe and plate workmanship qualification test using self- and gas-shielded FCAW on carbon steel in the 5G - 5F positions.

6) Pass a combination round tubing and sheet workmanship qualification test using GTAW on carbon steel, aluminum, and stainless steel in the 5F - 5G positions.
7) Demonstrate satisfactory performance using OFC and CAC-A in carbon steel, and PAC in carbon steel, aluminum and stainless steel.

5.1. The Level II - Advanced Welder shall prepare, by mechanical, oxyfuel gas, or plasma arc cutting, the parts as designated in Figures 1 through 5.

5.2. The Level II - Advanced Welder shall assemble the parts prepared in **5.1**, as shown in Figures 1 through 5.

5.3 The Level II - Advanced Welder shall weld the assemblies using the WPS indicated on the drawing for each assembly. The WPSs specified are listed in Annex D.

5.4 As an option, the Level II - Advanced Welder may perform the performance qualification tests as detailed in Annex C in accordance with Supplement G of AWS QC7, *Standard for AWS Certified Welders*. The purpose of AWS QC7 is to document the ability of welders to deposit sound welds (qualify) and to impose controls on the documentation and maintenance of certification (certify). Welder performance qualification tests administered within the AWS QC7 program are conducted at AWS Accredited Test Facilities. Such facilities operate under the requirements of AWS QC4, *Standard for Accreditation of Test Facilities for AWS Certified Welder Program*.

5.5 Participating Organizations may elect to substitute any of the performance qualifications listed in Annex C for the workmanship or performance qualification requirements detailed in Figures 1 through 5. Substituted performance qualifications shall cover all aspects of the replaced workmanship or performance qualification test, with respect to welding process, welding positions, base metal, filler metal and product form.

6. Inspection, Testing, and Acceptance Criteria

6.1 All cut edges shall be visually examined and the cut surfaces shall meet the criteria of AWS C4.1 Sample 2 with grinding. After inspection, the cut surfaces may be conditioned to bright metal.

6.2 All assemblies shall be visually examined and the welds shall meet the acceptance criteria shown in Table 1.

6.3 Butt joints welded with the shielded metal arc welding process in the 6G position shall be cut to produce face- and root-bend specimens as shown in Figure 7.

6.4 Face- and root-bend specimens shall be conditioned as shown in Figure 8, and bent in a bend fixture similar to Figure 9 or 10, in accordance with ANSI/AWS B4.0, *Standard Methods for Mechanical Testing of Welds*.

6.5 Face- and root-bend specimens after bending shall meet the requirements of Table 2.

7. Documentation

For each successful Level II - Advanced Welder, the Participating Organization shall prepare a report containing the following:

1) The Level II - Advanced Welder's name and Social Security Number,

2) The actual grade on the written examinations,

3) The actual grade on the Safety portion of the written examination,

4) The results of the visual inspection of each workmanship qualification test, and

5) The results of the SMAW 6G performance qualification test.

8. Certification

8.1 The Participating Organization shall send the report to the American Welding Society.

8.2 The American Welding Society shall enter the data into the Level II - Advanced Welder database.

9. National Registry of Level II - Advanced Welders

The Level II - Advanced Welder database shall function as the National Registry of Level II - Advanced Welders.

9.1 Persons listed in the databank are not required to maintain registration by reporting welding activities.

9.2 Public disclosure of individual records in the National Registry of Level II - Advanced Welders shall be at the discretion of the individual welders.

Table 1

Visual Inspection Criteria for Level II - Advanced Welders

1) There shall be no cracks or incomplete fusion.

2) There shall be no incomplete joint penetration in groove welds except as permitted for partial joint penetration groove welds.

3) The Test Supervisor shall examine the weld for acceptable appearance, and shall be satisfied that the welder is skilled in using the process and procedure specified for the test.

4) Undercut shall not exceed the lesser of 10% of the base metal thickness or 1/32 in. (0.8 mm).

5) Where visual examination is the only criterion for acceptance, all weld passes are subject to visual examination, at the discretion of the Test Supervisor.

6) The frequency of porosity shall not exceed one in each 4 in. (100 mm) of weld length and the maximum diameter shall not exceed 3/32 in. (2.4 mm).

7) Welds shall be free from overlap.

Table 2

Acceptance Criteria for Face- and Root-Bends

For acceptance, the convex surface of the face- and root-bend specimens shall meet both of the following requirements:

1. No single indication shall exceed 1/8" (3.2 mm), measured in any direction on the surface.

2. The sum of the greatest dimensions of all indications on the surface, which exceed 1/32" (0.8 mm), but are less than or equal to 1/8" (3.2 mm), shall not exceed 3/8" (9.6 mm).

Cracks occurring at the corner of the specimens shall not be considered unless there is definite evidence that they result from slag inclusions or other internal discontinuities.

Annex A

Workmanship Qualification Test Report

Visual Inspection

Name of Student: _____
Social Security No.: _____
Sample # _____

Size:

Under ___ OK ___ Excessive ___

Undercut:

Acceptable ___ Rejected ___

Porosity:

Diameter of Largest ___

Acceptable ___ Rejected ___

Overlap:

Acceptable ___ Rejected ___

Penetration:

Acceptable ___ Rejected ___

Appearance:

Acceptable ___ Rejected ___

Cracks:

Acceptable ___ Rejected ___

Name: _____ Date: _____
(Please Print)

Signature: _____

Annex B

Face- and Root-Bend Test Report

Name of Student: _____

Social Security No.: _____

6G Face-bend:

Length of each discontinuity (Over 1/32") ___ ___ ___ ___ Sum ___

Accept _____ Reject _____

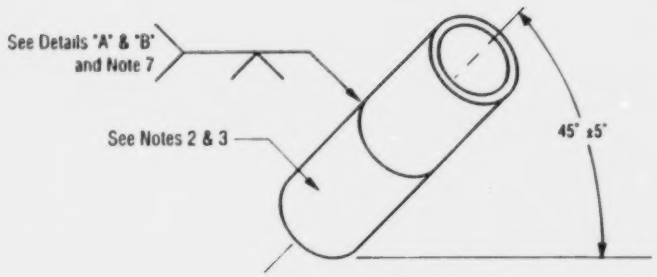
6G Root-bend:

Length of each discontinuity (Over 1/32") ___ ___ ___ ___ Sum ___

Accept _____ Reject _____

Name: _____ Date:
(Please Print)

Signature: _____



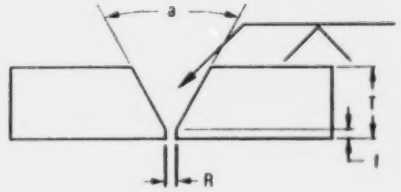
PIPE INCLINATION FIXED (45° ±5°) AND NOT ROTATED DURING WELDING

TEST POSITION 6G

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

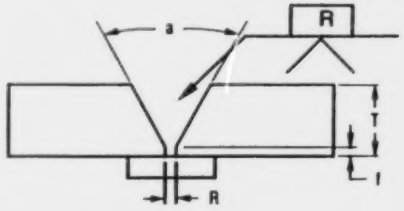
Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Performance Qualification for SMAW of carbon steel pipe.
2. 6" or 8" Ø Schedule 80 carbon steel pipe (M-1/P-1/S-1, Group 1 or 2).
3. The standard pipe groove test weldment for performance qualification shall consist of two pipe sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. With or without backing. Backing ring to suit diameter and nominal wall thickness of pipe. Refer to Details "A" and "B".
5. All welding done in position according to applicable performance qualification requirements.
6. All parts may be mechanically cut or machine OFC.
7. Use WPS ANSI/AWS B2.1-1-022 for performance qualification without backing.
   Use WPS ANSI/AWS B2.1-1-016 for performance qualification with backing.
8. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1.
   Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.1.2 and Figure 3.7.1B.



a = 60° minimum
R = 5/32", ±1/16"
f = 1/16 minimum

DETAIL "A" - Joint Geometry Without Backing

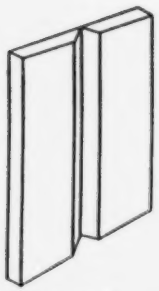


a = 60° minimum
R = 3/16", +1/4" -1/6
f = R/2 maximum

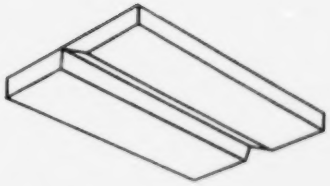
DETAIL "B" - Joint Geometry With Backing

Performance Qualification Test - SMAW, Carbon Steel, 6G Position

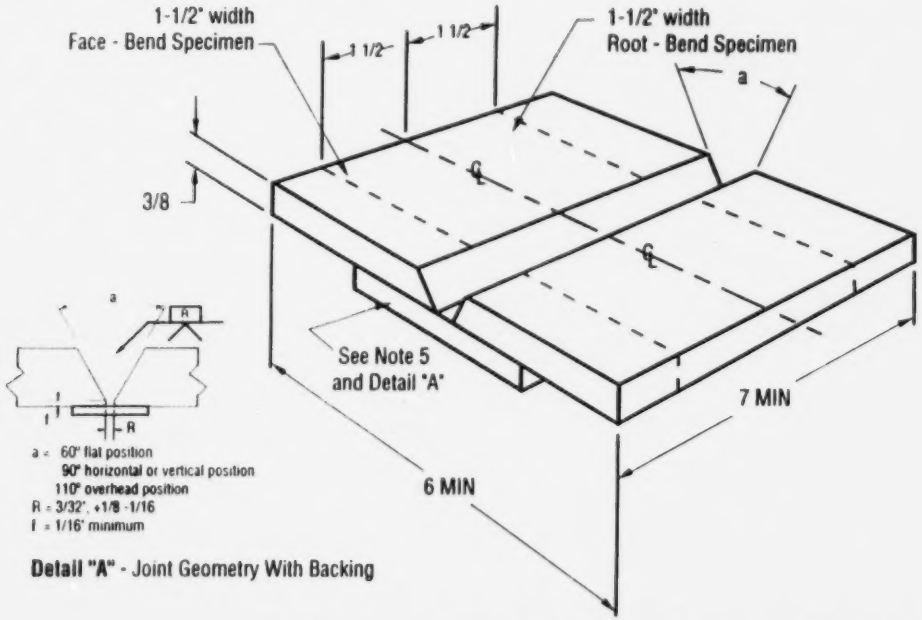
INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4



TEST POSITION 3G (Vertical Up)
(Plates Vertical, Axis of Weld Vertical)



TEST POSITION 4G (Overhead)
(Plates Horizontal)



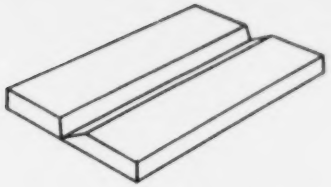
Detail "A" - Joint Geometry With Backing

Notes:

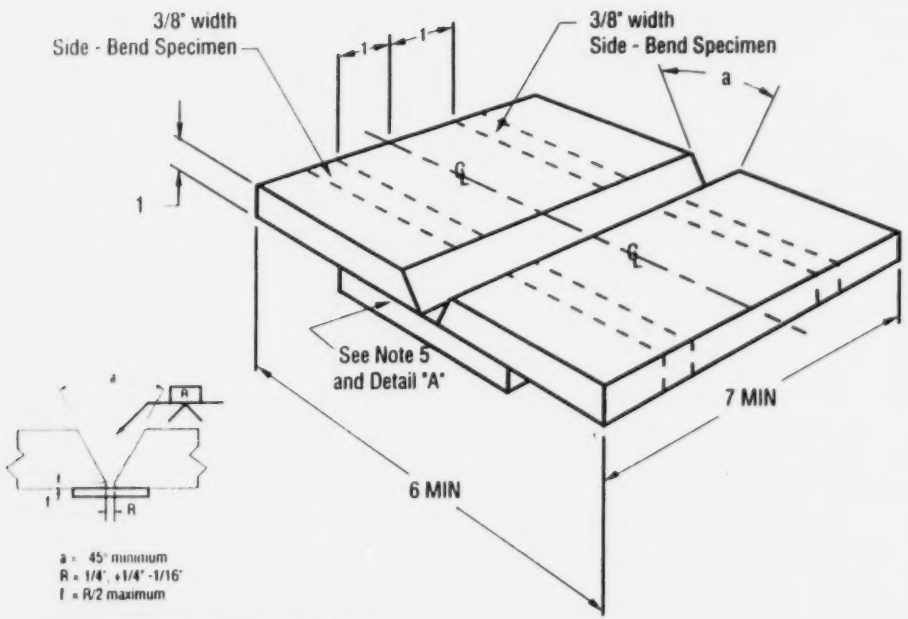
1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for GMAW (spray transfer) of aluminum
2. 3/8" thickness aluminum (M-23/P-23/S-23 or (M-22/P-22/S-22 to M-22/P-22/S-22), as detailed in AWS B2.1.
3. Performance Qualification #1 = 3G position.
   Performance Qualification #2 = 4G position.
4. All welding done in position according to applicable performance qualification requirement.
5. With backing. Backing material 1/4" x 3" x 7" minimum (M-23/P-23/S-23 to M-23/P-23/S-23) or (M-22/P-22/S-22 to M-22/P-22/S-22), as specified in AWS B2.1.
6. All parts may be mechanically cut or machine PAC.
7. Use WPS AWS2-1-GMAW for (M-23/P-23/S-23).
   Use WPS AWS2-1.1-GMAW for (M-22/P-22/S-22).
8. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1.
   Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.2.1 and Figure 3.7.2A.

Performance Qualification Test - GMAW Short Circuit, Carbon Steel, 3G - 4G Position

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4



TEST POSITION 1G (flat)
(Plates Horizontal)

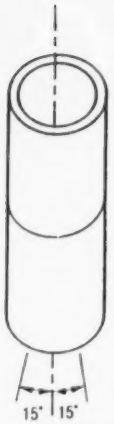


Detail "A" - Joint Geometry With Backing

Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for GMAW (spray transfer) of carbon steel pipe.
2. 1" thickness carbon steel (M-1/P-1/S-1, group 1 or 2), as detailed in AWS B2.1.
3. Performance Qualification #1 = 1G position.
4. All welding done in position according to applicable performance qualification requirement.
5. With backing. Backing material 1/4" x 3" x 7" minimum (M-1/P-1/S-1, Group 1 or 2) as specified in AWS B2.1.
6. All parts may be mechanically cut or machine OFC.
7. Use WPS AWS2-3-GMAW.
8. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1.
   Bend test as detailed and in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.2.1 and Figure 3.7.2A.

Performance Qualification Test - GMAW Spray Transfer, Carbon Steel, 1G Position



PIPE OR TUBE VERTICAL AND NOT ROTATED DURING WELDING. WELD HORIZONTAL (±15°).

TEST POSITION 2G (HORIZONTAL)

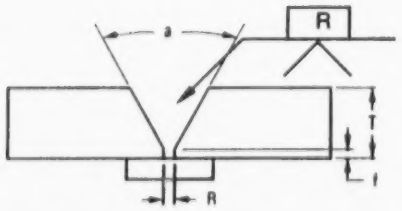
PIPE HORIZONTAL FIXED (±15°) AND NOT ROTATED DURING WELDING. WELD FLAT, VERTICAL, OVERHEAD.

TEST POSITION 5G (MULTIPLE)

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

Notes:

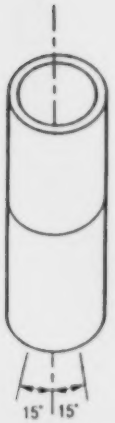
1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for FCAW-S (self-shielded) of carbon steel pipe.
2. 6" or 8" Ø Schedule 80 carbon steel pipe (M-1/P-1/S-1, Group 1 or 2).
3. The standard pipe groove test weldments for performance qualification shall consist of two pipe sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. Performance Qualification #1 = 2G position.
   Performance Qualification #2 = 5G position.
5. All welding done in position according to applicable performance qualification requirement.
6. With backing. Backing ring to suit diameter and nominal wall thickness of pipe. Refer to Detail "A".
7. All parts may be mechanically cut or machine OFC.
8. Use WPS ANSI/AWS B2.1-1-027.
9. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1.
   Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.1.2 and Figure 3.7.1C.



a = 60° minimum
R = 3/16", +1/4" -1/16"
f = R/2 maximum

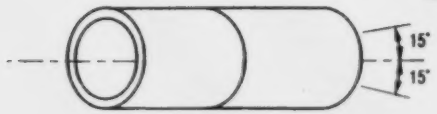
(A) Joint Detail - with backing

Performance Qualification Test - FCAW-S, Carbon Steel, 2G - 5G Position



PIPE OR TUBE VERTICAL AND NOT ROTATED DURING WELDING. WELD HORIZONTAL (±15°).

TEST POSITION 2G (HORIZONTAL)



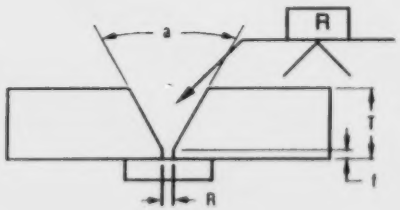
PIPE HORIZONTAL FIXED (±15°) AND NOT ROTATED DURING WELDING. WELD FLAT, VERTICAL, OVERHEAD.

TEST POSITION 5G (MULTIPLE)

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for FCAW-S (gas-shielded) of carbon steel pipe.
2. 6" or 8" Ø Schedule 80 carbon steel pipe (M-1/P-1/S-1, Group 1 or 2).
3. The standard pipe groove test weldments for performance qualification shall consist of two pipe sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. Performance Qualification #1 = 2G position.
   Performance Qualification #2 = 5G position.
5. All welding done in position according to applicable performance qualification requirement.
6. With backing. Backing ring to suit diameter and nominal wall thickness of pipe. Refer to Detail "A".
7. All parts may be mechanically cut or machine OFC.
8. Use WPS ANSI/AWS B2.1-1-019 or ANSI/AWS B2.1-1-020.
9. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1.
   Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.1.2 and Figure 3.7.1C.

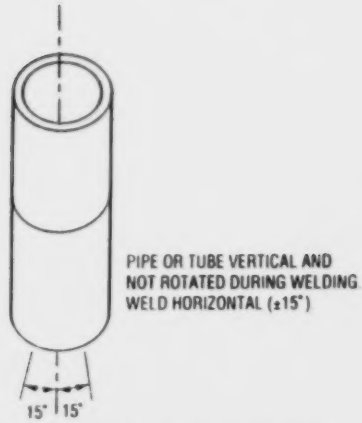


a = 60° minimum
R = 3/16", +1/4" -1/16"
f = R/2 maximum

(A) Joint Detail - with backing

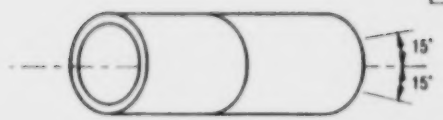
Performance Qualification Test - FCAW-G, Carbon Steel, 2G - 5G Position

BEST COPY AVAILABLE



PIPE OR TUBE VERTICAL AND NOT ROTATED DURING WELDING. WELD HORIZONTAL (±15°)

TEST POSITION 2G (HORIZONTAL)



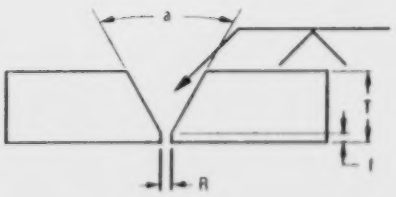
PIPE HORIZONTAL FIXED (±15°) AND NOT ROTATED DURING WELDING. WELD FLAT, VERTICAL, OVERHEAD.

TEST POSITION 5G (MULTIPLE)

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

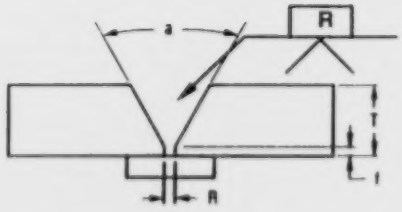
Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for GMAW (short circuit transfer) of carbon steel pipe.
2. 4" or 6" Ø Schedule 40 carbon steel pipe (M-1/P-1/S-1, Group 1 or 2).
3. The standard pipe groove test weldments for performance qualification shall consist of two pipe sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. Performance Qualification #1 = 2G position.
   Performance Qualification #2 = 5G position.
5. All welding done in position according to applicable performance qualification requirement.
6. With or without backing. Backing ring to suit diameter and nominal wall thickness of pipe. Refer to Details "A". and "B".
7. All parts may be mechanically cut or machine OFC.
8. Use WPS AWS2-2-GMAW.
9. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1.
   Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.1.2 and Figure 3.7.1C.



a = 60°, +10° -5°
R = 5/32", ±1/16"
f = 1/16 minimum

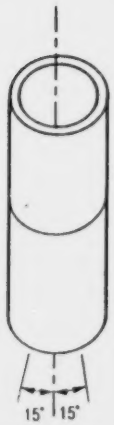
DETAIL "A" - Joint Geometry Without Backing



a = 60°, +10° -5°
R = 5/32", ±1/16"
f = 1/16 minimum

DETAIL "B" - Joint Geometry With Backing

Performance Qualification Test - GMAW-S, Carbon Steel, 2G - 5G Position



ROUND TUBING VERTICAL AND NOT ROTATED DURING WELDING. WELD HORIZONTAL (±15°).

TEST POSITION 2G (HORIZONTAL)

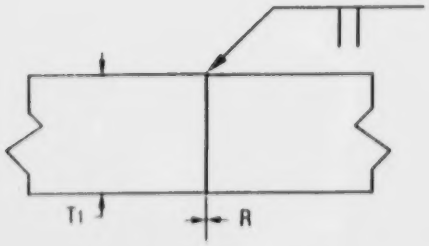
INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

ROUND TUBING HORIZONTAL FIXED (±15°) AND NOT ROTATED DURING WELDING. WELD FLAT, VERTICAL, OVERHEAD.

TEST POSITION 5G (MULTIPLE)

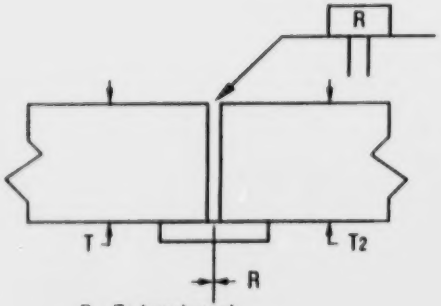
Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for GTAW of carbon steel round tubing.
2. 1" – 2-7/8" Ø, 10 ga. - 18 ga. carbon steel round tubing. Optional choice of diameter and wall thickness within range specified.
3. The standard round tubing groove test weldments for performance qualification shall consist of two round tubing sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. Performance Qualification #1 = 2G position. Performance Qualification #2 = 5G position.
5. All welding done in position according to applicable performance qualification requirement.
6. With or without backing. Backing ring to suit diameter and nominal wall thickness of pipe. Refer to Details "A" and "B".
7. Root shielding gas optional.
8. All parts may be mechanically cut or machine OFC.
9. Use WPS ANSI/AWS B2.1.008.
10. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1. Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.1.2 and Figure 3.7.1C. Bend specimens = 1/2" (13 mm) wide x 6 in (150 mm) long.



R = T1 (maximum)
T = 10 ga. through 18 ga.

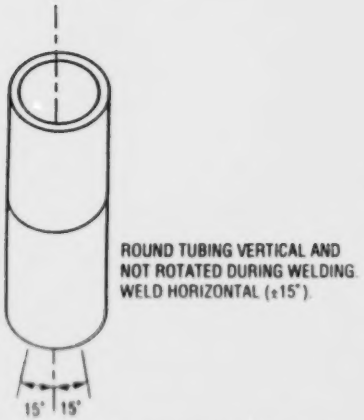
(A) Joint Detail - without backing



R = T1 (maximum)
T1 = T2
T = 10 ga. through 18 ga.

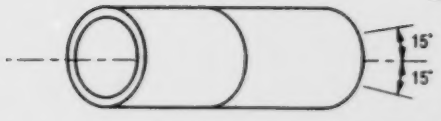
(B) Joint Detail - with backing

Performance Qualification Test - GTAW, Carbon Steel, 2G - 5G Position



ROUND TUBING VERTICAL AND NOT ROTATED DURING WELDING. WELD HORIZONTAL (±15°).

TEST POSITION 2G (HORIZONTAL)



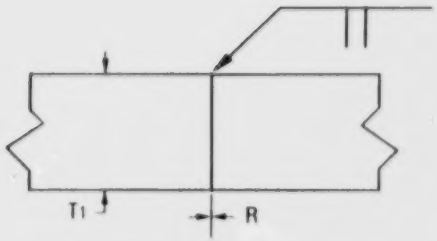
ROUND TUBING HORIZONTAL FIXED (±15°) AND NOT ROTATED DURING WELDING. WELD FLAT, VERTICAL, OVERHEAD.

TEST POSITION 5G (MULTIPLE)

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

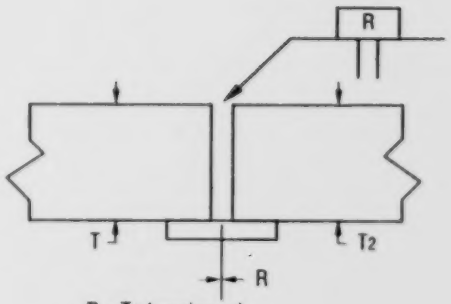
Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for GTAW of aluminum round tubing.
2. 1" – 2-7/8" Ø, 10 ga. - 18 ga. aluminum round tubing (M-22/P-22/S-22 to M-22/P-22/S-22) or (M-23/P-23/S-23 to M-23/P-23/S-23). Optional choice of diameter, wall thickness and material within range specified.
3. The standard round tubing groove test weldments for performance qualification shall consist of two round tubing sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. Performance Qualification #1 = 2G position.
   Performance Qualification #2 = 5G position.
5. All welding done in position according to applicable performance qualification requirement.
6. With or without backing. Backing ring to suit diameter and nominal wall thickness of pipe. Refer to Details "A" and "B".
7. Root shielding gas required.
8. All parts may be mechanically cut or machine PAC.
9. Use WPS AWS 2-1-GTAW for M-23/P-23/S-23.
   Use WPS AWS 2-1.1-GTAW for M-22/P-22/S-22.
10. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3 1.
    Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.1.2 and Figure 3.7.1C
    Bend specimens = 1/2" (13 mm) wide x 6 in (150 mm) long.



R = T1 (maximum)
T = 10 ga. through 18 ga.

(A) Joint Detail - without backing



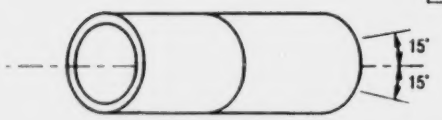
R = T1 (maximum)
T1 = T2
T = 10 ga. through 18 ga.

(B) Joint Detail - with backing

Performance Qualification Test - GTAW, Aluminum, 2G - 5G Position

ROUND TUBING VERTICAL AND NOT ROTATED DURING WELDING. WELD HORIZONTAL (±15°).

TEST POSITION 2G (HORIZONTAL)



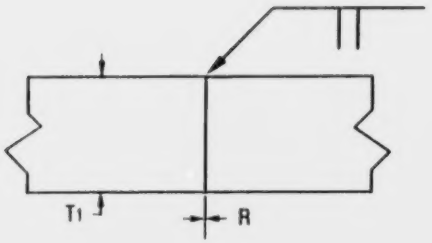
ROUND TUBING HORIZONTAL FIXED (±15°) AND NOT ROTATED DURING WELDING. WELD FLAT, VERTICAL, OVERHEAD.

TEST POSITION 5G (MULTIPLE)

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

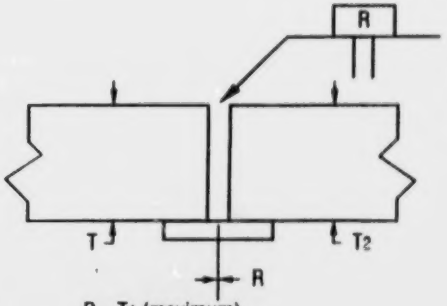
Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for GTAW of stainless steel round tubing.
2. 1" – 2-7/8" Ø, 10 ga. - 18 ga. stainless steel round tubing. Optional choice of diameter and wall thickness within range specified.
3. The standard round tubing groove test weldments for performance qualification shall consist of two round tubing sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. Performance Qualification #1 = 2G position. Performance Qualification #2 = 5G position.
5. All welding done in position according to applicable performance qualification requirement.
6. With or without backing. Backing ring to suit diameter and nominal wall thickness of pipe. Refer to Details "A" and "B".
7. Root shielding gas required.
8. All parts may be mechanically cut or machine OFC.
9. Use WPS ANSI/AWS B2.1.009.
10. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1. Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.1.2 and Figure 3.7.1C. Bend specimens = 1/2" (13 mm) wide x 6 in (150 mm) long.



R = T1 (maximum)
T = 10 ga. through 18 ga.

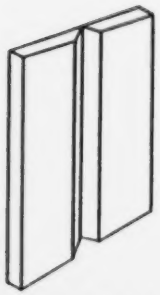
(A) Joint Detail - without backing



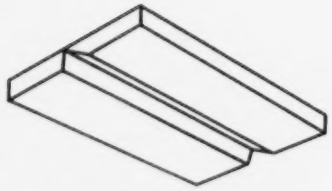
R = T1 (maximum)
T1 = T2
T = 10 ga. through 18 ga.

(B) Joint Detail - with backing

Performance Qualification Test - GTAW, Stainless Steel, 2G - 5G Position



TEST POSITION 3G (Vertical Up)
(Plates Vertical; Axis of Weld Vertical)

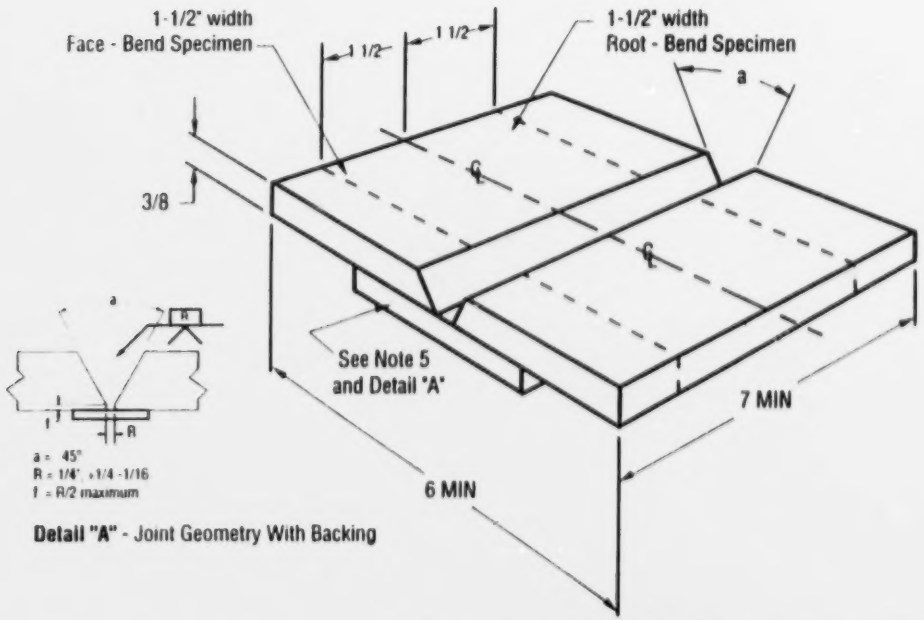


TEST POSITION 4G (Overhead)
(Plates Horizontal)

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

Notes:

1. Administration of this performance qualification test in accordance with AWS QC7, Supplement G, supersedes AWS QC11 and AWS EG3.0 requirements of Workmanship Qualification for SMAW of stainless steel.
2. 3/8" thickness austenitic stainless steel (M-8/P-8/S-8, Group 1), as detailed in AWS B2.1 and WPS ANSI/AWS B2.1-8-023.
3. Performance Qualification #1 = 3G position.
   Performance Qualification #2 = 4G position.
4. All welding done in position according to applicable performance qualification requirement.
5. With backing. Backing material 1/4" x 3" x 7" minimum (M8/P-8/S-8, Group 1) as specified in AWS B2.1.
6. All parts may be mechanically cut or machine PAC.
7. Use WPS ANSI/AWS B2.1-8-023
8. Visual examination in accordance with the requirements of AWS B2.1, sections 3.5.1 and 3.5.3.1.
   Bend test in accordance with the requirements of AWS B2.1, sections 3.5.3.1, 3.7.2.1 and Figure 3.7.2A.



Detail "A" - Joint Geometry With Backing

Performance Qualification Test - SMAW, Stainless Steel, 3G - 4G Position

BEST COPY AVAILABLE

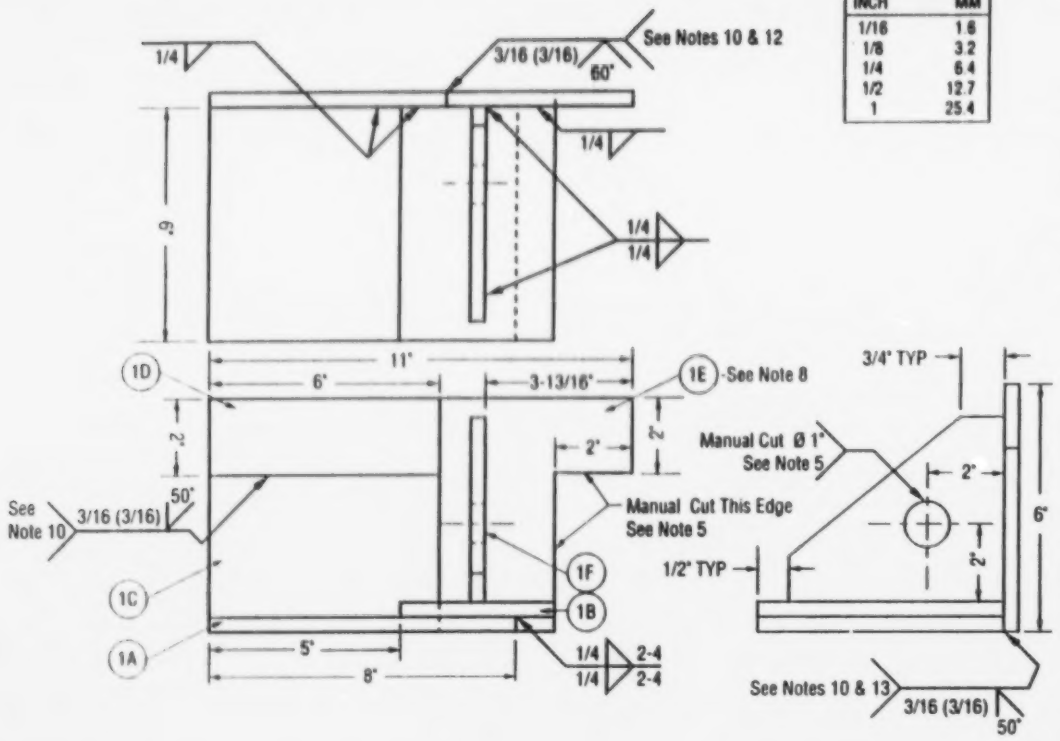
Annex D

Welding Procedure Specifications

ANSI/AWS B2.1	*Standard for Welding Procedure and Performance Qualification*
ANSI/AWS B2.1.008	*Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding of Carbon Steel (M-1, Group 1) 10 Gage through 18 Gage, in the As-Welded Condition, With or Without Backing*
ANSI/AWS B2.1.009	*Standard Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding of Austenitic Stainless Steel, (M-8/P-8), 10 Gage through 18 Gage, in the As-Welded Condition, With or Without Backing*
ANSI/AWS B2.1-1-016	*Standard Welding Procedure Specification (WPS) for Shielded Metal Arc Welding of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E7018, As-Welded or PWHT Condition*
ANSI/AWS B2.1.019	*Standard Welding Procedure Specification (WPS) for CO2 Shielded Flux Cored Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded Condition*
ANSI/AWS B2.1.020	*Standard Welding Procedure Specification (WPS) for 75% Argon 25% CO2 Shielded Flux Cored Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E70T-1 and E71T-1, As-Welded or PWHT Condition*
ANSI/AWS B2.1-1-022	*Standard Welding Procedure Specification (WPS) for Shielded Metal Arc Welding of Carbon Steel, (M-1/P-1/S-1, Group 1 or 2), 1/8 through 1-1/2 inch Thick, E6010, (Vertical Uphill) Followed by E7018, As-Welded or PWHT Condition*
ANSI/AWS B2.1-8-023	*Standard Welding Procedure Specification (WPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel, (M-8/P-8/S-8, Group 1 or 2), 1/8 through 1-1/2 inch Thick, As-Welded Condition*
ANSI/AWS B2.1-1-027	*Standard Welding Procedure Specification (WPS) for Self-Shielded Flux Cored Arc Welding of Carbon Steel, (M-8/P-8/S-8, Group 1 or 2), 1/8 through 3/4 inch Thick, E71T-11, As-Welded Condition*
AWS2-1-SMAW	*Welding Procedure Specification (WPS) for Shielded Metal Arc Welding of Austenitic Stainless Steel to Carbon Steel, (M-1 to M-8 or P-8), 1/8 through 1/2 inch Thick, in the As-Welded Condition*
AWS2-1-GMAW	*Welding Procedure Specification (WPS) for Gas Metal Arc Welding - Spray Transfer of Aluminum, (M-23/P-23/S-23), 1/8 through 3/4 inch Thick, in the As-Welded Condition*
AWS2-1.1-GMAW	*Welding Procedure Specification (WPS) for Gas Metal Arc Welding - Short Circuit Transfer of Aluminum, (M-22/P-22/S-22), 1/8 through 3/4 inch Thick, in the As-Welded Condition*
AWS2-2-GMAW	*Welding Procedure Specification (WPS) for Gas Metal Arc Welding - Short Circuit Transfer of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 inch through 3/8 inch Thick, in the As-Welded Condition*

Annex D

AWS2-3-GMAW	*Welding Procedure Specification (WPS) for Gas Metal Arc Welding - Spray Transfer of Carbon Steel (M-1/P-1/S-1, Group 1 or 2), 1/8 inch through 3/8 inch Thick, in the As-Welded Condition*
AWS2-1-GTAW	*Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding of Aluminum, (M-23/P-23/S-23), 10 through 18 Gauge Thick, in the As-Welded Condition*
AWS2-1.1-GTAW	*Welding Procedure Specification (WPS) for Gas Tungsten Arc Welding of Aluminum, (M-22/P-22/S-22), 10 through 18 Gauge Thick, in the As-Welded Condition*

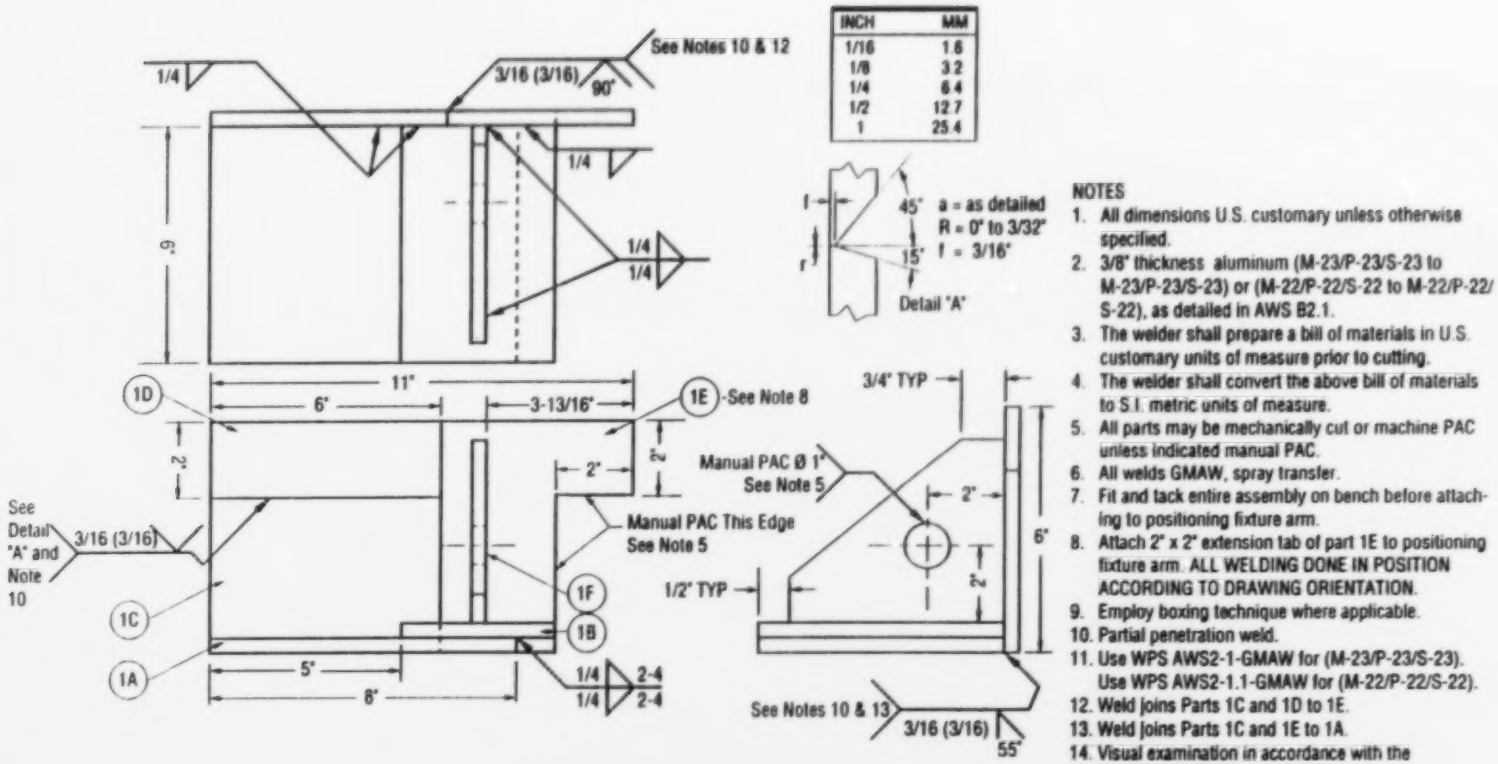


INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 1/4" thickness carbon steel material.
   1/4" thickness 3XX stainless steel material (optional).
3. The welder shall prepare a bill of materials in U.S. customary units of measure prior to cutting.
4. The welder shall convert the above bill of materials to S.I. metric units of measure.
5. All carbon steel parts may be mechanically cut or machine OFC unless indicated "Manual Cut" then use manual OFC.
   All stainless steel parts may be mechanically cut or machine PAC unless indicated "Manual Cut" then use manual PAC.
6. Filler metals as specified by WPS. (See Note 11)
7. Fit and tack entire assembly on bench before attaching to positioning fixture arm.
8. Attach 2" x 2" extension tab of part 1E to positioning fixture arm. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
9. Employ boxing technique where applicable.
10. Partial penetration weld.
11. Use WPS AWS2-1-SMAW for carbon steel base metal.
    Use WPS ANSI/AWS B2.1-8-023 for stainless steel base metal.
12. Weld joins Parts 1C and 1D to 1E.
13. Weld joins Parts 1C and 1E to 1A.
14. Visual examination in accordance with the requirements of AWS QC11, Table 1.

Figure 1 - SMAW Workmanship Qualification Test

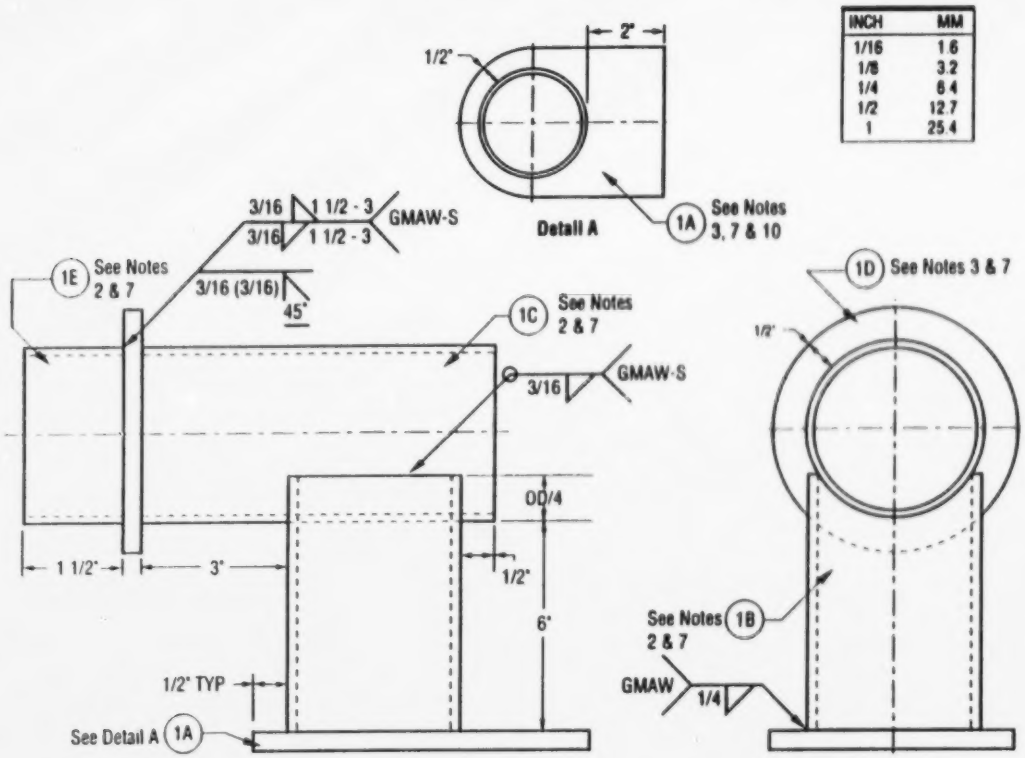


INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 3/8" thickness aluminum (M-23/P-23/S-23 to M-23/P-23/S-23) or (M-22/P-22/S-22 to M-22/P-22/S-22), as detailed in AWS B2.1.
3. The welder shall prepare a bill of materials in U.S. customary units of measure prior to cutting.
4. The welder shall convert the above bill of materials to S.I. metric units of measure.
5. All parts may be mechanically cut or machine PAC unless indicated manual PAC.
6. All welds GMAW, spray transfer.
7. Fit and tack entire assembly on bench before attaching to positioning fixture arm.
8. Attach 2" x 2" extension tab of part 1E to positioning fixture arm. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
9. Employ boxing technique where applicable.
10. Partial penetration weld.
11. Use WPS AWS2-1-GMAW for (M-23/P-23/S-23). Use WPS AWS2-1.1-GMAW for (M-22/P-22/S-22).
12. Weld joins Parts 1C and 1D to 1E.
13. Weld joins Parts 1C and 1E to 1A.
14. Visual examination in accordance with the requirements of AWS QC11, Table 1.

Figure 2 - GMAW (Spray Transfer) Workmanship Qualification Test



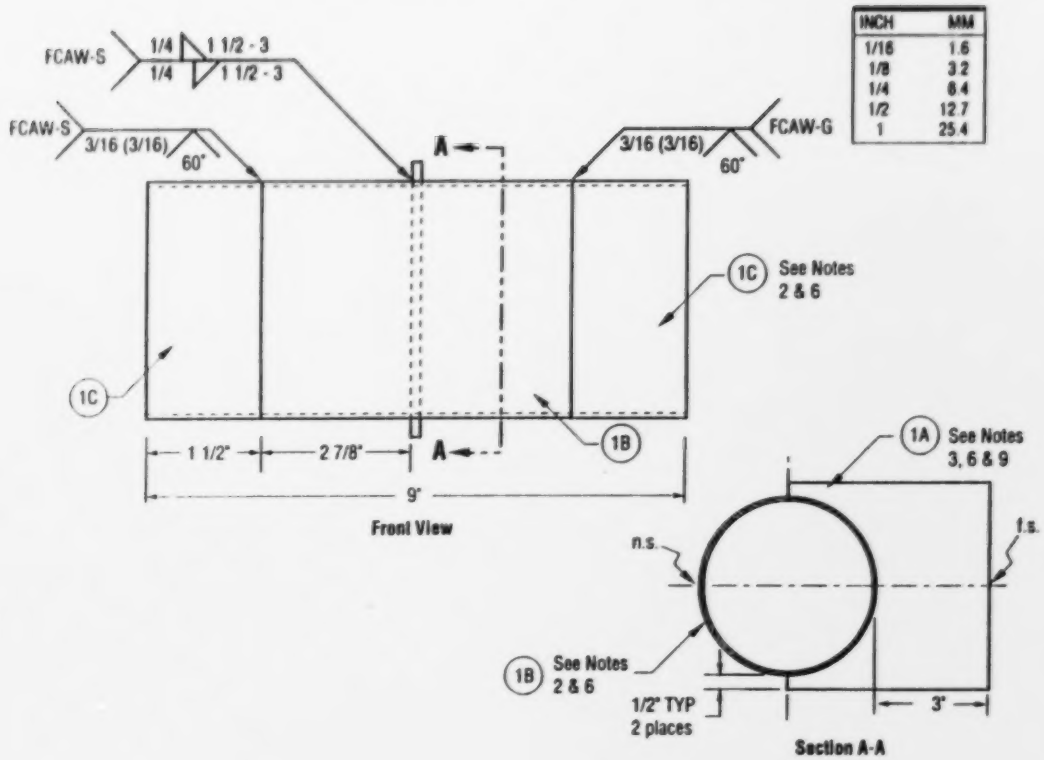
INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 4" - 6" Ø Schedule 40 carbon steel pipe. Optional choice of pipe diameter within range specified.
3. 1/4" thickness carbon steel plate. Useable pieces may be joined to obtain design size Parts 1A & 1D. If joined all additional welds shall be ground flush prior to assembly of AWS2-3 weldment.
4. Use .035 diameter E70S-X electrode.
5. The welder shall prepare a bill of materials in U.S. customary units of measure prior to cutting.
6. The welder shall convert the above bill of materials to S.I. metric units of measure.
7. Parts 1A,1B & 1D manual OFC. Saddle Part 1B to accommodate Part 1C. Parts 1C & 1E may be mechanically, machine OFC, or manual OFC cut.
8. All welds GMAW-S or GMAW (spray) as specified.
9. Fit and tack entire assembly on bench before welding.
10. Attach Part 1A to welding table or positioning fixture arm. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
11. Melt through not required.
12. Use WPS AWS2-2-GMAW for short circuiting transfer. Use WPS AWS2-3-GMAW for spray transfer.
13. Visual examination in accordance with the requirements of AWS QC11, Table 1.

Figure 3 - GMAW (Spray and Short Circuit Transfer) Workmanship Qualification Test

BEST COPY AVAILABLE

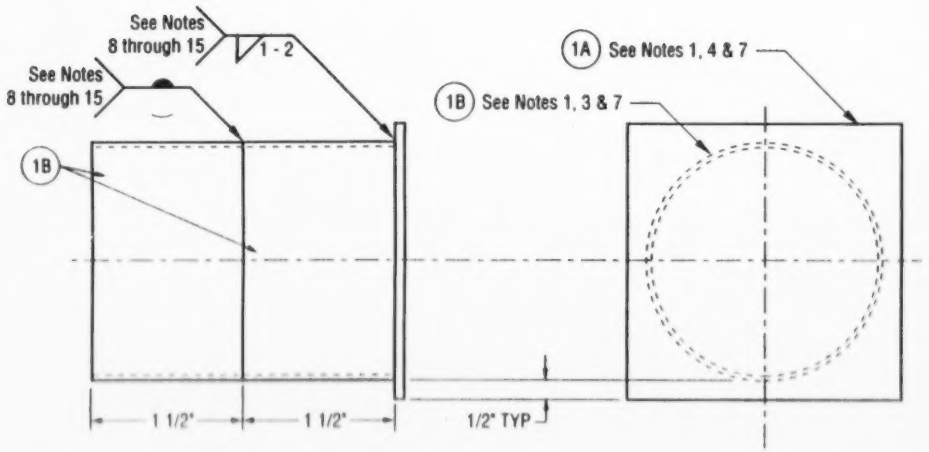


INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

NOTES

1. All dimensions U.S. customary unless otherwise specified.
2. 4" - 6" Ø Schedule 40 carbon steel pipe. Optional choice of pipe diameter within range specified.
3. 1/4" thickness carbon steel plate. Useable pieces may be joined to obtain design size Part 1A, If joined all additional welds shall be ground flush prior to assembly of AWS2-4 weldment.
4. The welder shall prepare a bill of materials in U.S. customary units of measure prior to cutting.
5. The welder shall convert the above bill of materials to S.I. metric units of measure.
6. Part 1A manual OFC. Parts 1B & 1C may be mechanically, machine OFC, or manual OFC cut.
7. All welds FCAW-S or FCAW-G as specified.
8. Fit and tack entire assembly on bench before welding.
9. Attach far side of part 1A to positioning fixture arm. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
10. Melt through not required.
11. Use WPS ANSI/AWS B2.1.020 or ANSI/AWS B2.1.019 for gas-shielded.
    Use WPS ANSI/AWS B2.1-1-027 for self-shielded.
12. Visual examination in accordance with the requirements of AWS QC11, Table 1.

Figure 4 - FCAW-S and FCAW-G Workmanship Qualification Test



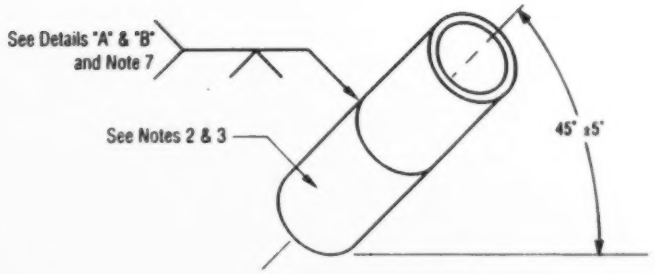
INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4

NOTES

1. 1 each required, carbon steel, aluminum and stainless steel.
2. All dimensions U.S. customary unless otherwise specified.
3. 3" Ø, 10 ga. - 18 ga. thickness round tubing.
   Optional choice of wall thickness within range specified.
4. 10 ga. - 18 ga. material thickness for sheet.
   Optional choice of thickness within range specified.
5. The welder shall prepare a bill of materials in U.S. customary units of measure prior to cutting.
6. The welder shall convert the above bill of materials to S.I. metric units of measure.
7. Part 1A manual PAC. Part 1B may be mechanically or manual PAC cut. Uniformly radius all sharp corners.
8. All Welds GTAW. Fillet weld size = 1 1/2 times the nominal wall thickness of the round tubing. Groove weld root opening = 1/2 the nominal wall thickness of the round tubing.
9. Groove weld joint geometry 16-18 gage use square groove. Groove weld joint geometry 10-14 gage use v-groove.
10. No melt through on fillet welds.
11. Root shielding gas required for aluminum and stainless steel.
12. Fit and tack entire assembly on bench before welding.
13. ALL WELDING DONE IN POSITION ACCORDING TO DRAWING ORIENTATION.
14. Use WPS ANSI/AWS B2.1.008 for carbon steel
    Use WPS AWS2-1-GTAW for aluminum (M-23/P-23/S-23).
    Use WPS AWS2-1.1-GTAW for aluminum (M-22/P-22/S-22).
    Use WPS ANSI/AWS B2.1.009 for stainless steel.
15. Visual examination in accordance with the requirements of AWS QC11, Table 1.

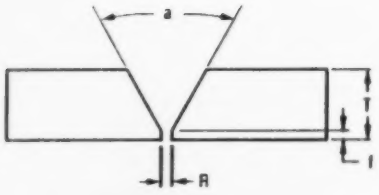
Figure 5 - GTAW Workmanship Qualification Test

INCH	MM
1/16	1.6
1/8	3.2
1/4	6.4
1/2	12.7
1	25.4



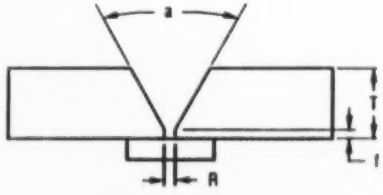
PIPE INCLINATION FIXED (45° ±5°) AND NOT ROTATED DURING WELDING

TEST POSITION 6G



a = 60° minimum
R = 1/8", +1/16" -1/16"
f = 1/16 maximum

DETAIL "A" - Joint Geometry Without Backing



a = 60° minimum
R = 3/16", +1/4" -1/16"
f = R/2 maximum

DETAIL "B" - Joint Geometry With Backing

Notes:

1. Duplicate performance qualification tests are not required if welder is tested under AWS QC11 using the AWS QC7 option.
2. 6" or 8" Ø Schedule 80 carbon steel pipe. Pipe diameter optional within range specified.
3. The standard pipe groove test weldment for performance qualification shall consist of two pipe sections, each a minimum of 3 in. (76 mm) long joined by welding to make one test weldment a minimum of 6 in. (150 mm) long.
4. With or without backing. Refer to Details "A" and "B". Backing ring to suit diameter and nominal wall thickness of pipe.
5. All welding done in position according to applicable performance qualification requirement.
6. All parts may be mechanically cut or machine OFC.
7. Use WPS ANSI/AWS B2.1-1-022 for performance qualification without backing.
   Use WPS ANSI/AWS B2.1-1-016 for performance qualification with backing.
8. Visual examination in accordance with the requirements of QC11, Table 1. Bend test in accordance with the requirements of QC11, Table 2 and Annex D, Figures 7 and 8.

Figure 6 - SMAW Performance Qualification Test

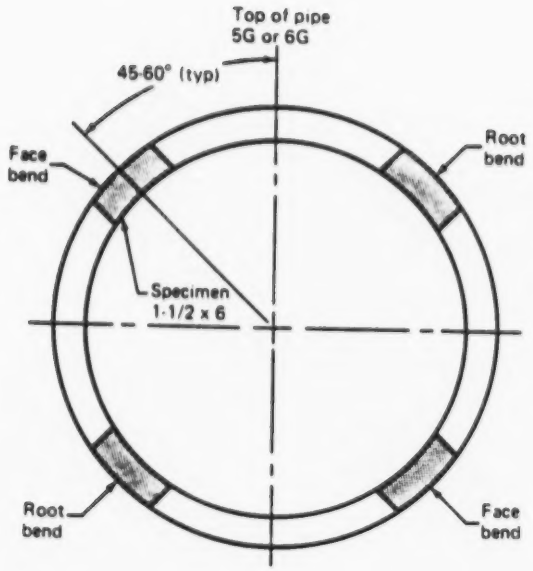
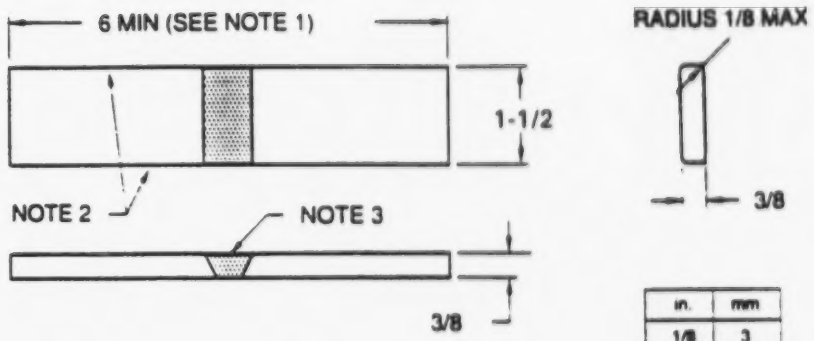


Figure 7 - SMAW Test Pipe Specimen Location



in.	mm
1/8	3
3/8	10
1-1/2	38
6	150

Notes:

1. A longer specimen length may be necessary.
2. These edges may be oxygen-cut and may or may not be machined.
3. The weld reinforcement, and any backing, shall be removed flush with the surface of the specimen.
4. Cut surfaces shall be smooth and parallel.

Figure 8 - Face- and Root-Bend Specimens

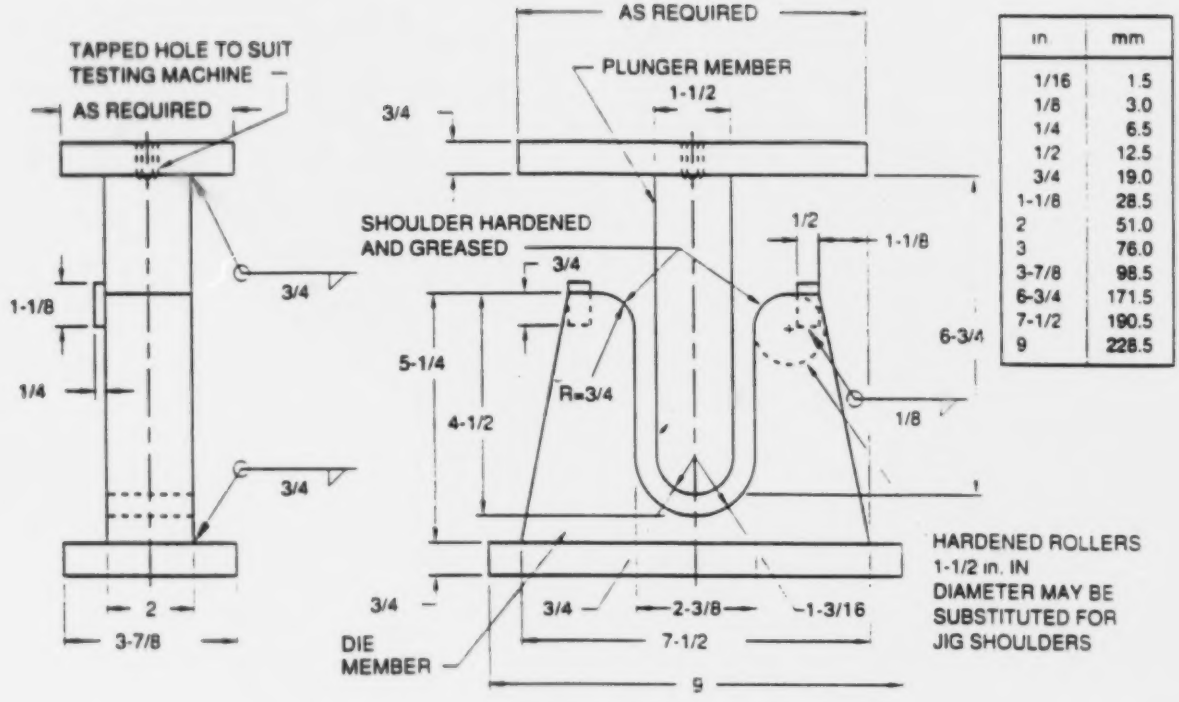


Figure 9 - Typical Guided-Bend Test Fixture

in.	mm
3/8	10
7/16	11
3/4	19
1-1/2	38

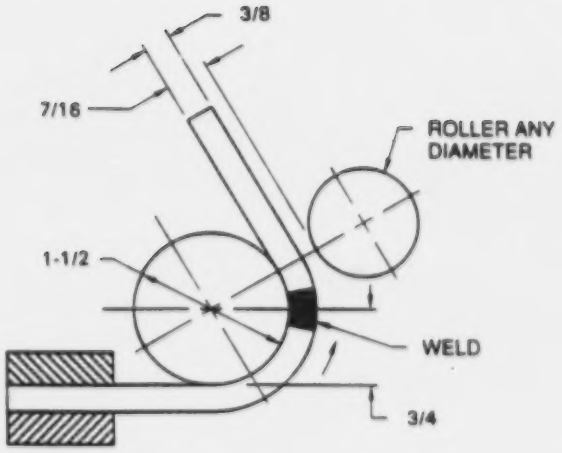


Figure 10 - Alternative Wrap Around Bend Test Fixture